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ABSTRACT

This paper documents the need for new instructional methods to use with students who have disabilities, by citing results from a survey of 46 Oklahoma schools, which gathered data on the modifications used for mainstreamed students with disabilities. Next, the critical research on learning and on computer assisted instruction is summarized. A multimedia project called "Linkway for Oklahoma" is then described, from the initial writing of a grant proposal through various stages of decisions regarding equipment purchases and advantages and shortcomings of particular pieces of equipment. Contains 24 references. (DB)

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HOW TO GET STARTED IN MULTIMEDIA INSTRUCTION

by

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Presented at the CEC Annual Convention
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HOW TO GET STARTED IN MULTIMEDIA INSTRUCTION

Elizabeth Walters, Ph.D., M. K. Betz, Ph.D.
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Need for New Methods

Students with handicaps are being mainstreamed into regular classrooms with varying degrees of success while others are instructed in special education classrooms due to the difficulty in providing appropriate instruction in the regular classroom. (McIntosh, R. et al, 1993, Storey, K., 1993). A recent (spring, 1992) survey of schools in the southern and southeast quadrant of Oklahoma revealed the number of students mainstreamed into Oklahoma History classes together with the types of adaptions and modifications made. All 86 schools were surveyed. Of the 46 surveys which were returned, 230 students were mainstreamed in regular Oklahoma History Classes. As part of the survey, the respondents were asked to check the modifications that their schools were providing for those students. The survey itself was adapted from one found in The Learning Disabled Child in Oklahoma, 1990. p. 45. Adaptations were broken down into the following areas: a) exam modifications, b) modifications of assignments, c)adaptations of regular assignments, d) alternative supplementary materials to he regular text, e) alternatives to written/reading assignments, and f) alternatives in presenting content. The investigators added an option in each area for computers. The results of the survey may be found in Table 1.

Insert Table 1 about here.

Some of the recommended modifications are time consuming and repetitive. For instance, "reduce the reading assignment (read...reword, edit)". Such a modification is an excellent idea. However, not only is it time consuming, but it is beyond the expected expertise of most secondary teachers to analyze the vocabulary, sentence length, and units of meaning in their textbooks. Some content area books are published in lower reading levels and when they are available many of the problems created by textbooks which are too difficult for students with reading handicaps is eliminated. However, such textbooks are not available for all content courses. There remains a need for making information available to students who are unable to read well enough or have other handicapping conditions which make it difficult to access their textbooks.

REVIEW OF THE CRITICAL RESEARCH ON LEARNING

Current research, while building on findings indicating the vital role teachers play in stimulating student learning, also focuses on the role of the student. It recognizes that students do not merely passively receive or copy input from teachers, but instead actively mediate it by trying to make sense of it and to relate it to what they already know about the topic (Brophy, 1992). Brophy contends that students develop new knowledge through a process of active construction. They need to get beyond rote memorization to achieve true understanding. In order to do that, they need to develop a network of associations linking new input to preexisting knowledge and beliefs anchored in concrete experiences. Thus, teaching involves inducing conceptual change in students, not just the infusion of knowledge.

"To the extent that new learning is complex, the construction of meaning required to develop clear understanding of it will take time and will be facilitated by the interactive discourse that occurs during lessons and activities." (Brophy, 1992, p. 5) Brophy further states that these activities allow students to process the content actively and "make it their own" by paraphrasing it into their own words.

Prawat, (1992) also reminds us that Piaget found that "real learning" is not simply parroting back of information. Real learning involves personal invention or construction. Cognitive psychologists have identified " the former experience" as the most important predictor of a child's conceptual understanding (Chi, 1978). This holds true over more general characteristics such as age and IQ. Too often, school history classes with their modifications for special students evolve into just the memorization of facts. Students with learning handicaps, many with short-term memory and reading problems, and others with serious mobility and sensory handicaps, are reduced to attempting to avoid failure grades on report cards. There is little true learning for such students.

REVIEW OF THE PERTINENT LITERATURE ON CAI

Investigations until only recently have shed little light on the effectiveness of computer assisted instruction (CAI) for students with handicapping conditions. The microcomputer seemed to be underutilized or ineffectively used in the special education curriculum (Cartwright, Cartwright, & Ward, 1984). Lee (1987) investigated the reason for such underutilization and found that educational researchers too often work in isolation. One group of researchers concluded that the quality of courseware must improve in order to promote achievement of our students with handicaps (McDermott & Watkins, 1983). However, Lee found no follow-up research to support this.

Another group of researchers (Grimes, 1982; Hegarty, 1982; Hofmeister, 1982) reported that certain components of computer courseware must be present for CAI to be of benefit to learners

with handicaps. Lee (1987) found that their assertions had never been tested. He therefore sought to establish the first empirically derived guidelines for the production and evaluation of microcomputer courseware for students who are handicapped. As a result, his research established the following Essential Components which are listed in rank order:

1. Directions the students must read should be simple enough so as not to interfere with the students' comprehension.
2. The courseware must provide alternate means of presenting the same concept if students do not comprehend the first presentation (recasting).
3. The screen must be uncluttered.
4. Students should be able to operate the program with minimal keyboard skills.
5. The program must provide praise/feedback regarding the correctness or incorrectness of responses.
6. The courseware must provide adequate opportunities for students to review concepts.
7. The software must teach very basic skills that nonhandicapped students would learn incidentally.

Since these early efforts at establishing essential components for instructional design several researchers have added to the body of knowledge to help drive the development of CAI. One such research team (Collins & Carnine, 1988) compared two versions of a reasoning skills program through a field test revision process. Through the field testing they altered the original version of the reasoning program in four major ways. One was to introduce invalid evidence earlier. Is this way they were able to help ADD students to focus their attention on the validity of arguments. The second was to delay drawing -conclusions tasks. Students could not seem to learn to do this until after they had practiced evaluating evidence. The third change was to focus on evidence when critiquing arguments. The fourth change was to eliminate nonessential vocabulary. One other important revision was made. That was to sequence the tasks from harder-to-easier to help the students with learning disabilities to attend carefully. This is in direct opposition to the conventional wisdom of sequencing form easy-to-difficult.

Hagan (1984) reported that the computer is the first educational tool that has the capability of truly teaching students through their modality strength. Technology has advanced CAI to the exciting expectation of true learning for all students with handicapping conditions. Studies suggest that while people remember only 20% of what they hear, and 40% of what they see and hear, they remember 75% of what they see, hear, and do (Graves, 1992). With multimedia, students can see images in motion on the computer screen, listen to the program with headphones and actually perform lessons using the keyboard and mouse. Using a mouse enables students to control a story themselves, returning to those sections they may not have fully understood the first time around

or those they may have found especially interesting. Graves (1992) further reports that a recent study by the Department of Defense concludes that multimedia instruction can increase student performance by as much as 50%.

Horton, et al (1990) investigated the effectiveness of a computerbased study guide with handicapped high school students. The study guide used hypertext software for four levels of instructional cues that matched students to their highest level of independent interaction with a textbook passage. Hypertext is a generic term for high-level software which allows users to interact with information in a non-liner fashion (Megarry, 1988). In a hypertext format, a study guide page might be thought of as several sheets of transparent plastic overlaying each other. The top layer not only provides the original text to be read by the students, but also serves as a point of departure for accessing additional information or for receiving more explicit instructional clues. This layering allows the pupil to interact with information on a variety of instructional levels. By placing the cursor on specified areas of the surface layer, the layers beneath can be reached. Thus, the research by Horton, et al (1990) focused on a technological mean of matching the level of instructional cues with the child's highest level of independent interaction with a textbook passage.

Higgens and Boone (1990) also developed study guides for social studies. After reviewing their experimental study, they concluded that:

1. Use of the hypertext computer study guide resulted in lower achieving students receiving a passing grade on daily quizzes.
2. Use of the hypertext computer study guides resulted in score increases from pretest to post test for lower achieving students.
3. Use of the hypertext computer study guides resulted in little knowledge loss from post test to retention test for lower achieving students. pp. 539-540.

Higgens and Boone (1990) concluded that, "For high school students with learning disabilities, the opportunity to have access to information more that once and have control over the presentation of that material may mean the difference between passing or not passing a course". (p. 540).

The whole concept of interactivity needs to be thought of in terms of quality, not just quantity of response, explains Chen (1990). He reported that Cohen (1984) suggested three important techniques for enhancing quality of interactivity when designing interactive materials: 1) nonlinear format of content: allowing learners to choose various paths through a program based upon individual needs, 2) feedback which ensures remediation: locating errors and informing the learners why it is wrong and how to correct it, and 3) learner control options: allowing learners to

control the content, pace, and instructional strategies. He cautions that the design of an interactive program must contain built-in learner control options, so that a learner can direct his or her own learning process. These options include choices at the curriculum level, amount of time needed, and sequence of instructional strategies. Such features will ensure a richer instructional dialogue between the learner and the material and promote a greater amount of achievement. **In practice, program developers must combine three quite different types of knowledge: knowledge of subject matter, knowledge of teaching strategies, and knowledge of the student's cognitive structures.**

HISTORY OF THE PROJECT

Liz Walters, professor of special education, has been teaching since 1953. Desktop computers had not even been dreamed about when she was doing er undergraduate work. In the 60's she used her university's mainframe and cards with holes to analyze data from her thesis. In the 70's, at still another university, that was still the case when she working on her dissertation. It wasn't until the 80's that an Apple IIe came to be an integral part of her office. In other words, she had no courses and no training in using computers.

Chip Weiner, assistant professor education in special education, being much younger than Liz, had more experiences with computers. He was recruited for his expertise in working with high school students with learning disabilities. He has been adding to his skills and knowledge in educational technology as it is required. both special educators consider themselves well versed in adapting curriculum and instruction to fit the unique needs of students with handicapping conditions.

M.K. Betz, assistant professor of education, was recruited for his expertise in educational technology. Although his experience with multimedia was limited it was far more than that of Chip or Liz, so he was put in charge of telling the others what was needed and how to use it once it was acquired.

Which way to go?

After reading the exciting research and development being done using Hypercard and a Mac, Liz was anxious to buy one and get started. However, other faculty members had IBM's and her chair was encouraging her to upgrade in that direction. In 1991 at a Retool Project she was introduced to Linkway. Linkway for IBM was purported to be similar to Hypercard. The decision was made! Go Linkway and IBM.

Where to get the money for equipment?

She invited two co-workers to collaborate with her to write a grant proposal in order to do research in the special education field utilizing multimedia. The initial grant was for less than

$30,000.00 from the Oklahoma State Department of Education, Special Education Section. The team entitled their project, "Linkway for Oklahoma". The Durant Public Schools were pleased to cooperate with them to field test the programs and to be a vital part of the research. Two Oklahoma History teachers were recruited to help at each step in the development of the programs.

More equipment?

In 1992 Liz went to a multimedia training program put on by the research team from Vanderbilt, entitled, "anchored Instruction in MultiMedia." The wonders of the video-disk were well planted and a "have to have one" was well established. In 1993 an in-house grant from Southeastern's Faculty Research Fund was used to add more equipment, software, and to sustain the project.

More equipment? More Money?

In 1994 still another grant proposal was submitted to the Oklahoma State Department of Education, Special Education Section to continue this project. As the multimedia station become increasingly cumbersome and complicated, the need for a way to disseminate the modules was evident. A means of downloading to a CD-ROM will be one way to go.

EQUIPMENT FOR THE PROJECT

Essentially, there were three levels of multimedia equipment acquisition, corresponding to the three stages of the project. Each stage of development of the project was determined in part by the previous stage, due to the fact that multimedia production is so new and rare. Therefore, the learning curve proved significant in that modifications in original estimations had to be made.

Stage 1

The first stage corresponded to the initial project parameters, which centered around two major components: the IBM SLC 57/PS2 Computer and Linkway Live! version 1.0, multimedia authoring system software. The SLC 57 computer was produced by the Multimedia division of IBM and was packaged as the "Advanced Academic System." Originally, the SLC 57 came equipped with a 386 microprocessor chip, but a coupon was included to facilitate the purchase of a discounted 486 chip, which was added later on. A catalog of the features of this multimedia computer (one of the first on the market!) include: an IBM 8515 XGA, 14" monitor; an enhanced keyboard and enhanced mouse; a built-in CD-ROM drive; a 160Mg hard drive; 8Mg of RAM; a Caere Typist Plus (hand-held) scanner for scanning test and graphics for incorporation into software programs; an M-Audio Capture & Playback Adapter and an M-Motion Video Adapter/A for capturing and digitizing audio and video; and a full contingent of Windows-based multimedia software.

The major significance of Stage 1 equipment relates to the novelty of a multimedia producing, desktop computer system. At the onset of the project in the Fall of 1992, the sheer size of the computer, both in memory and storage, was impressive. Although a user of Windows since 1988, never had Dr. Betz seen so much variety associated with Windows use; there were well over 30 unique programs accessible. Further, the SLC 57 computer included a CD-ROM drive and a hand-held scanner, both items close to the "cutting edge" for that time. In truth, the set-up was somewhat intimidating even for a person with desktop publishing experience and many years of multiple-platform computing.

Stage 2

The second stage of the Linkway for Oklahoma! project brought the purchase of additional equipment which was deemed necessary based on our experiences with the original contingent of hardware. The primary purchases consisted of a Pioneer CLD-V2400 LaserDisc Player (which can access compact discs, both audio and video, of 3-inch, 5-inch, 8-inch, and 12-inch size), a Hewlett-Packard DeskScan II flatbed color scanner, a PanelBook 550 Active Matrix Color LCD Projection Panel, and Linkway Live!, version 1.1. Another important purchase of the second stage involved the acquisition of sophisticated cables to connect the sometimes incongruously configured equipment.

The shortcomings of our planning, due to the novelty of the project, and the hidden particulars of the original equipment configuration prompted the purchases for Stage 2. First, we found that the M-Motion Video Adapter/A was basically a pass through video port and any purported digitizing capabilities were, for the most part, negligible. The use of a VCR was ruled out because of the wind and rewind time required for its use. That left us with the option of using a laserdisc and the Pioneer CLD-V2400 LaserDisc Player, on which we could play our original laserdisc and import video via the M-Motion Video Adapter. To our delight, we found that the LaserDisc/M-Motion Video Adapter combination worked quite well.

The HP ScanJet II was added to supersede the scanning capabilities of the Caere Typist Plus, handheld scanner. The typist was effective with scanned text, but for the purposes of our project, the utility of scanned text was minimal. What we really needed was a scanner that could import color pictures into our Linkway folders. The PanelBook 550 Active Matrix color LCD Projection Panel was purchased to facilitate presentations, and all of us agree that it is a gem.

Stage 3

The third stage of the project, in proposal form at present, involves the purchase of an IBM Value Point computer with a 486 microprocessor, 66-33 MGz capability, 16 Mg RAM, 1Mg video, and an IBM 2G hard drive. To be used in conjunction with the Value Point

is a Philips CD-521 CD Presser with Tempra CD-Maker software. Additional equipment needed in Stage 3 includes approximately 15 CD-ROM blank discs, two Master laserdiscs, and 10 broadcast quality s-videotapes. Probably the most significant change in hardware with respect to the original equipment configuration will be the purchase of an Action Media II mother and daughter card to allow full-scale video capturing and digitizing.

As much as we were "ahead of the game" with our original equipment purchase in 1992, so too is the purchase of the IBM Value Point with its superhuge, 2G hard drive and the Philips CD-ROM Presser. The Multimedia environment is progressively moving toward a CD-ROM based platform, as is most probably the universe of personal computing. There are a few hangups with CD-ROM however, which center around the inability of microcomputer users o do anything with CD-ROM'S except consume them. The above equipment along with appropriate software will allow an entire multimedia program to be assembled on the ValuePoint, downloaded to the CD Presser, resulting in a self-contained, run-time version.

The Action Media II mother and daughter card will replace the M-Motion Video Adapter/A (The cards cannot be used simultaneously) in Stage 3. The Action Media II card has all the basic capabilities of the M-Motion card, that is, it will serve as a passthrough conductor of full motion video. Additionally, it will allow for full-motion video to be digitized and stored to disc. It is the digitized, storable video that makes the most of CD capabilities and obviates the need for accompanying video input devices.

PIT FALLS & TOE STUBS

(Liz)

"One major pit fall has been expecting more of the equipment than it is capable of delivering. For instance, I had this notion that sound would be a fantastic way of delivering instruction for students who could not read. However, the Multimedia IBM Computer came equipped with an M-Audio device with serious limitations in memory. Hence, the thought of putting optional sound to the entire project had to be scrapped."

"Another problem centered on the amount of time that is required to develop new skills. What with teaching and advising, not much time is left to put in the hours necessary to understand and become consumers of this new technology."

(M.K.B.)

"1. LINKWAY is a DOS program and the SLC 57 computer software is Windows based. The CAERE scanner is a Windows-based device. The Windows shell blocked access to some of the multimedia capabilities. This basic incompatibility problem has never gone away. We are changing to Toolbook.

2. The SLC 57 computer has a difficult configuration scheme. Peripheral devices require particular settings for

optimal use that are not documented. The configuration utility program included with the computers was not specific to the advanced academic system, as it should have been.

3. The Linkway Live!, Linkway Capture tool, did not capture graphics which were resident in Windows-based programs, the only programs we had that incorporated graphics.
4. The HP ScanJet II scanner, and all peripherals must work with IBM's microchannel architecture, which varies form the ISA bus architecture. This is not always the case. The up-grade of Toolbook will correct this problem.
5. The Linkway Live! software program is too simple to allow much in the way of audio input and the existing audio input through the M-Audio Capture/Playback device via microphone was of poor quality. (See #3)
6. Equipment orders were regularly troublesome due to either our purchasing department or supplier problems."

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LINKWAY FOR OKLAHOMA

How many handicapped students are mainstreamed into Oklahoma history? 230

Please check the modifications that your school provides for those handicapped children.

MODIFICATION SURVEY **SCHOOLS REPORTING 46**

A. EXAM MODIFICATIONS (180)

1. reduce the number of exams to ___
2. open book exams (notes, texts, etc.)
3. allow more time for regular exams
4. reduce the length of the regular exam
5. use more objective items (fewer essay responses)
6. give same exam orally
7. student gives test answers on tape, not written
8. reduce the reading level of the test (paraphrase, etc.)
9. write down test item for students
10. read test items to the student
11. give take-home tests
12. substitute assignment for test
13. other (computers, etc.) _____

B. MODIFICATIONS IN ASSIGNMENTS (110)

1. repeat instructions/provide more detailed directions
2. provide course syllabus/outline
3. use individual learning packages with clearly stated objectives
4. use progress charts, informal individual feedback interviews, etc.
5. give instructions through several channels, (written, oral, etc.)
6. provide materials that are programmed/self-checking
7. brief the student on key points before starting an assignment

ADAPT THE REGULAR ASSIGNMENTS: (137)

8. require fewer correct responses in order to achieve a specific grade
9. allow more time for regular assignments
10. reduce the length of the regular assignments
11. break the assignment into a series of smaller assignments
12. reduce the reading level of the regular assignment (reword, edit)
13. underline/outline major points in the regular assignment
14. change the format of the instructional materials (fewer problems)

USE ALTERNATIVE SUPPLEMENTARY MATERIALS TO THE REGULAR TEXT (WORKBOOK, EDIT) (61)

15. use different format materials to teach the same content (puzzles, games, tapes, etc.)
16. use high interest/motivating materials along with drill materials
17. use interest checklists, informal interviews to determine student interests
18. use adaptive equipment/facilities (jigs, ramps, etc.)
19. provide study aids (hints, cue cards, spelling list, guides, calculators)

USE ALTERNATIVES TO WRITTEN/READING ASSIGNMENTS (46)

20. performance/"hands-on" activities/physical assignments
21. oral presentations/reports/projects/role-play, etc.
22. other (computers, etc.) _____

C. ALTERNATIVES IN PRESENTING CONTENT (125)

1. use of outline presented before the lecture
2. make cassette recording of the lecture for individual playback
3. use of handouts, transparencies, maps, charts to emphasize major points in lecture
4. speak more slowly
5. allow teacher aide/volunteer to take notes for the student
6. allow classroom peer to make carbon copies for the student
7. use of individualized learning centers, contracts or learning packages
8. provide laboratory/"hands-on"/learning by discovery experience
9. use of programmed learning/self-checking materials
10. use of independent study experiences
11. other (computers, etc.) _____